1978

A preliminary study on the protein requirement of Chanos chanos (Forskal) fry in a controlled environment

Lim, Chhorn

Aquaculture Department, Southeast Asian Fisheries Development Center

Lim, C., Sukhawongs, S., & Piedad-Pascual, F. (1978). A preliminary study on the protein requirement of Chanos chanos (Forskal) fry in a controlled environment. SEAFDEC Aquaculture Department Quarterly Research Report, 2(1), 18-25.

http://hdl.handle.net/10862/2310

A preliminary study on the protein requirement of *Chanos chanos* (Forskal) fry in a controlled environment

by
Chhorn Lim, Somchart Sukhawongs
and
Felicitas Piedad Pascual

The primary concern in fish culture is to increase fish production per unit of culture space. Supplementary feeding with artificial diets is an effective measure for increasing fish production. However, to render the production economical, supplemental diets must be formulated in accordance with the basic nutritional requirements of the particular species. There is however a dearth of studies regarding nutritional requirements for the milkfish, *Chanos chanos* (Forskal), one of the important food fish which has been cultured in the Philippines, Indonesia and Taiwan for centuries.

Protein, being the principal diet component for growth has been the nutrient that is given priority in nutritional requirement studies. Its quality and quantity markedly affect the growth response of fishes. Its high cost also affect the economics of seafarming.

This experiment was designed to determine the optimum dietary level of protein necessary for satisfactory growth and survival of milkfish reared in a controlled environment.

Ten 60-L rectangular wooden-glass aquaria were used in this feeding study. Each aquarium had an individual air supply and was filled with approximately 30 liters of sand-gravel filtered seawater from the bay of Tigbauan. Water temperature range was 25-28°C and salinity 32-34 ppt.

Wild collected milkfish fry with an average weight of 40 mg were acclimatized for one week prior to the start of the experiment. During this period they received a diet containing 30% protein at a rate of 15% of biomass. They were randomly selected and stocked at a rate of 40 fish / aquarium.

Five semi-purified diets using casein as the protein source were prepared containing 20, 30, 40, 50 and 60% protein and 2500 Kcal of D.E./kg and fed at a rate of 10% of their biomass/day for a period of 30 days. Milkfish fry were fed twice daily and were weighed and counted every 10 days to record weight gain and survival rate. Feed allowances were adjusted every 10

days.

The growth rate of fish appeared to be related to the levels of the protein in the diet up to 40%. Fish fed the diet containing 40% protein had the highest weight gain and was significantly higher ($P < 0.05$) than those receiving 20 and 30% protein in the diets. (See Figure 1). Fish fed the diets, containing 50 and 60% protein grew slower than those fed the 40% protein diet. Thus a dietary level of protein of 40% seemed to be optimum for milkfish feed fry when fed at a rate of 10% of body weight.

Feed efficiency expressed in feed conversion values (Table 2) is a reflection of the weight gain. The best feed conversion of 1.96 was obtained from the 40% protein diet. However, no statistical differences ($P<0.05$) were found among fish fed various dietary levels of protein. Nevertheless, those diets with lower or higher protein levels tended to be less efficient.

The mean survival rates were low in all treatments but was highest for the 40% protein diet. No significant difference ($P < 0.05$) however was found in the survival rates of fish receiving different rations.

Results obtained from this study indicate that the optimum dietary level of protein for maximum growth of milkfish (*Chanos chanos*) fry fed 10% of biomass per day in a controlled environment is 40%. This quanity was also necessary to maintain fish against environmental stresses. Increasing the dietary levels of protein beyond 40% slightly retarded the growth rate. This could be due to the toxic effect of high protein content in the diets with insufficient non-protein energy as has been reported in channel catfish by Prather and Lovell (1973).

Table 1. Composition of 5 isocaloric experimental diets containing various levels of protein.

Ingredients	Percentages of ingredients in diets				
	1	2	3	4	5
Casein	22	33	44	55	66
Dextrin	60.4	45.8	31.2	16.8	1.5
Cod liver oil	3	3	3	3	3
Corn oil	3	3	3	3	3
C.M.C.	3	3	3	3	3
Vitamin mix[1]	3	3	3	3	3
Mineral mix[2]	5.6	5.6	5.6	5.6	5.6
B.H.T.	0.02	0.02	0.02	0.02	0.02
Celite	0	3.6	7.4	10.6	14.9
Estimated protein (%)	20	30	40	50	60
Determined protein (%)	24.0	31.0	39.1	48.2	56.9
Estimated D.E. (kcal/kg)[3]	2,740	2,740	2,740	2,740	2,740

[1] Vitamin mix (mg/kg diet): Thiamine, 10; riboflavin, 20; pyridoxine, 15; folic acid, 5; pantothenic acid; 40; choline chloride, 3,000; niacin, 150; vitamin B_{12}, 0.02; vitamin A, 4; vitamin D, 10; Vitamin E, 50; menadione-Na-bisulfite, 80; inositol, 400; biotin, 2; vitamin C, 300; B.H.T., 0.50; celite, 25,913.48.

[2] Mineral mix (g/kg diet): $CaHPO_4 \cdot 2H_2O$, 20.7; $CaCO_3$, 14.8; KH_2PO_4, 10.0; KCl, 1.0; NaCl, 6.0; $MnSO_4 \cdot H_2O$, 0.35; $FeSO_4 \cdot 7H_2O$, 0.5; $MgSO_4$, 3.0; KIO_3, 0.01; $CuSO_4 \cdot 5H_2O$, 0.03; $ZnCO_3$, 0.15; $CoCl_2$, 0.0027; $NaMoO_4 \cdot 2H_2O$, 0.0083; Na_2SeO_3, 0.0002.

[3] Estimated D.E. was based on the value for channel catfish (Wilson 1977):
Protein: 3.5 kcal/kg
Fat : 8.1 kcal/kg
NFE : 2.5 kcal/kg

Table II. Weight gains, diet conversions and survival rates for milkfish (*Chanos chanos*) fry fed various dietary levels of protein.[1]

Dietary levels of protein *(%)*	Weight gain per fish (mg)	Diet conversion	Survival rate *(%)*
20	43.3[a]	2.46[a]	7.5[a]
30	65.5[a]	2.20[a]	12.5[a]
40	134.7[b]	1.96[a]	30.0[a]
50	112.3[b]	1.99[a]	27.5[a]
60	110.0[b]	2.02[a]	28.8[a]

[1] Treatment means with the same superscript are not statistically different at $P<0.05$.

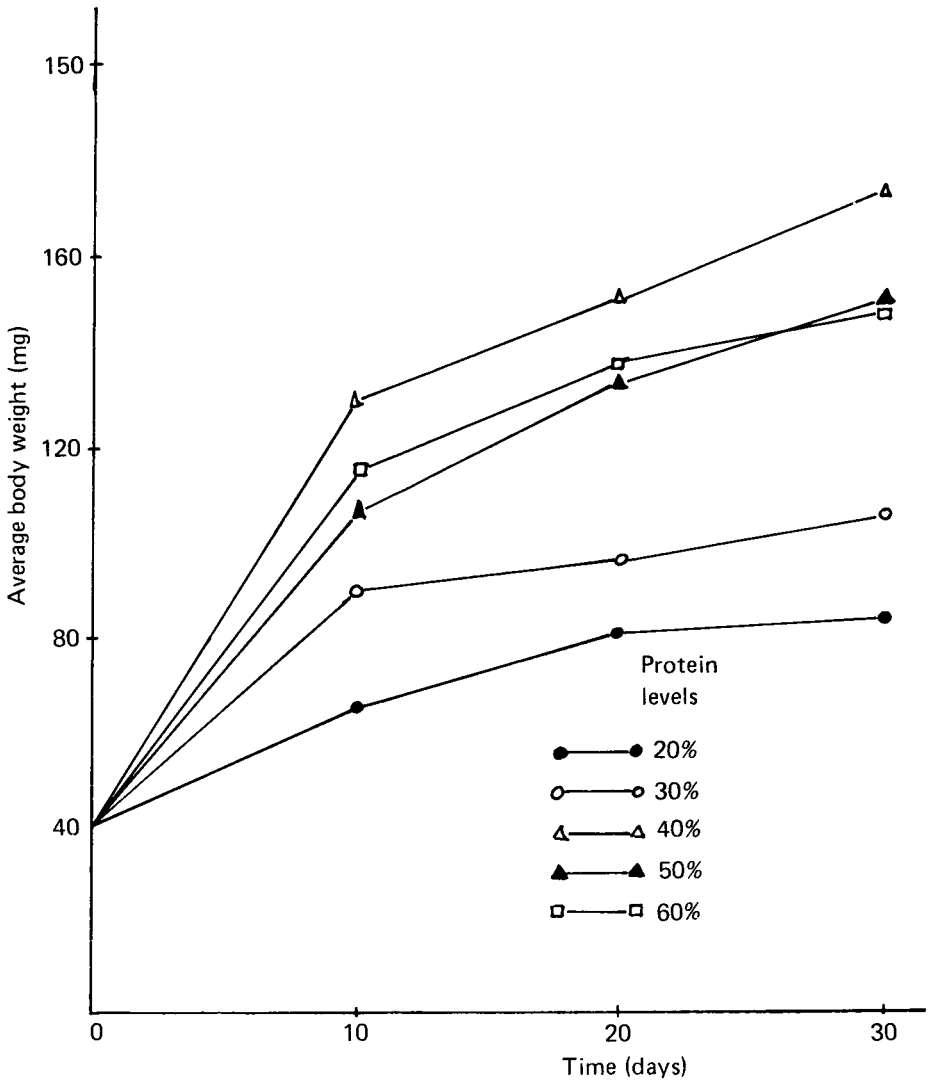

Fig. 1. Growth curve for milkfish fry fed diets containing various levels of protein.

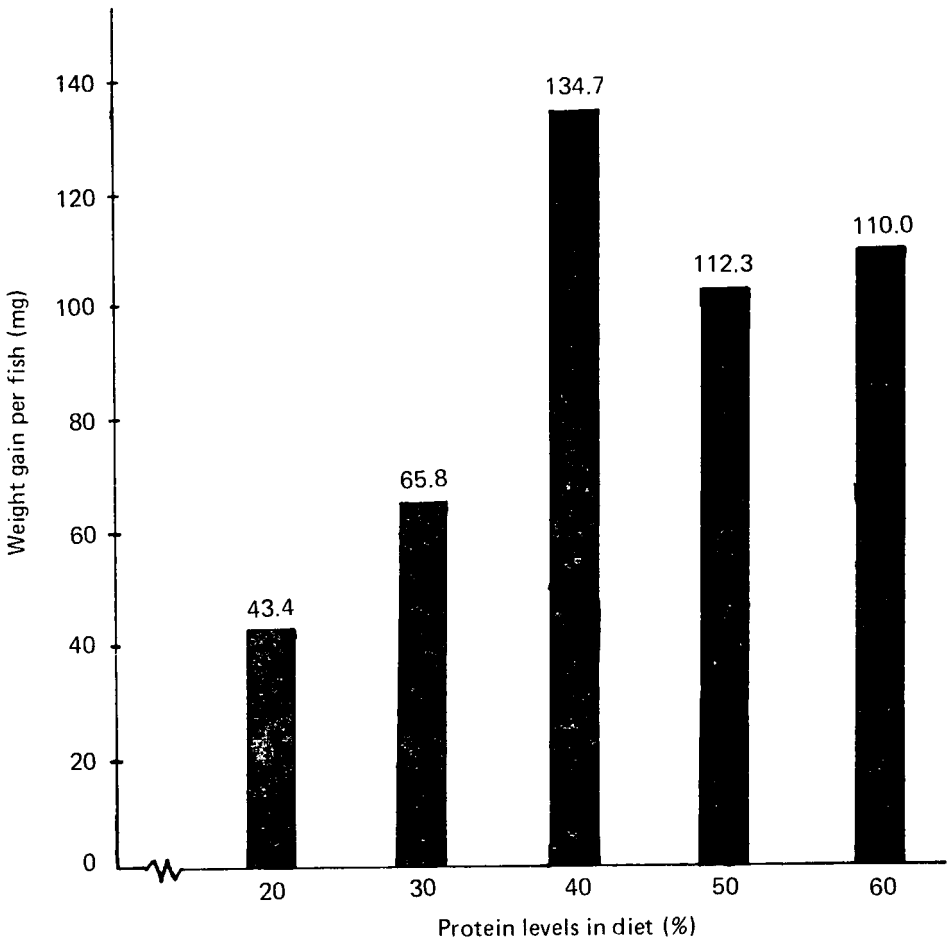

Fig. 2. Relationship between weight gains of milkfish fry and the dietary levels of protein.

REFERENCES

Cowey, C. B., Pope, J. A., Adron, J. W. and Blair, A., 1972. Studies on the nutrition of marine flat fish. The protein requirement of plaice *Pleuronectes platessa.* Br. J. Nutr., 28: 447-456.

Dabrowski, K., 1977. Protein requirement of grass carp (*Ctenopharyngodon idella* val.). Aquaculture, 12 (1): 63-73.

Delong, D. C., Halver, J. E. and Mertz, E. T., 1958. Nutrition of salmonid fish V I. Protein requirements J. Nutr., 65: 589-599.

Deyoe, C. W., Teimeier, O. W. and Suppres, C., 1968. Effects of protein, amino acid levels and feeding methods on growth of fingerling channel catfish. The Prog. Fish Cult., 30(4): 187-195.

Dupree, H. K. and Sneed, K. E., 1966. Responses of channel catfish fingerling to different levels of major nutrients in purified diets. U. S. Dept. of the Interior. Bur. Spt. Fish Wildlf., Techn. Paper No. 9, 21 pp.

Halver, J. E., 1976. Formulating practical diets for fish. J. Fish. Res. Board Can., 33: 1032-1039.

Lee, D. L. and Liao, I. C., 1976. A preliminary study on the purified test diet for young milkfish *Chanos chanos.* Proc. Int. Milkfish Workshop Conf. May 19-22, 1976, Tigbauan, Iloilo, Philippines, pp. 104-120.

Lovell, R. T., 1969. Nutrition in commercial catfish culture. Presented at the 99th Meeting of the Am. Fish. Soc., September 26, 1969, New Orleans, Louisiana, 33 pp.

Nail, M. L., 1962. The protein requirements of channel catfish, *Ictalurus punctatus* (Rafinesque). Proc. Conf. Southeast Assoc. Game and Fish Comm., 16:307-316.

Ogino, C. and Saito, K., 1970. Protein nutrition in fish I. The utilization of dietary protein by young carp. Jpn. Soc. Sci. Fish., 36:250-254.

Prather, E. E. and Lovell, R. T., 1973. Response of intensively fed channel catfish to diets containing various protein-energy ratios. Dept. of Fisheries and Allied Aquacultures. Auburn Agric. Exp. Stat., Auburn, Alabama, 11 pp.

Simco, B. A. and Cross. F. B., 1966. Factors influencing growth and production of channel catfish, *Ictalurus punctatus.* University of Kansas Publication, Museum of Nat. Hist., 17 (4): 191-256.

Wilson, R. P., 1977. Energy relationships in catfish diets. In: R. R. Stickney and R. T. Lovell (Editors), Nutrition and feeding of channel catfish. Southern Cooperative Series Bull. 218. Auburn Agric. Exp. Stat., Auburn, Alabama, pp. 21-29.